Preface

This book was initiated as part of a research project on the development strategy of "Basic Scientific Questions in High Magnetic Field" led by Dr. Baogen Shen and Dr. Yuheng Zhang, which discusses about the progresses and future directions in physics, material sciences, chemistry as well as life sciences in high magnetic field in mainland China. This particular book mainly focuses on the progresses of interdisciplinary researches of high magnetic fields and life sciences by researchers from mainland China. The topics covered can be roughly divided into two major categories. One is to study the effects of high magnetic fields on biological samples, such as cell, humans and animals. The other is to utilize techniques that based on high magnetic field to study biological questions, such as using NMR (Nuclear Magnetic Resonance) and MRI (Magnetic Resonance Imaging) in structural biology and medical imaging.

It should be noted that the exact definition of *High Magnetic Field* is currently obscure, which depends on specific research field. For physics and material sciences, magnetic fields of higher than 10 Tesla are considered to be high. However, in most other cases, magnetic fields of higher than 1 Tesla can be considered as high. For human beings, animals and other biological samples, magnets of a few thousand Gausses are already strong enough to elicit some responses, especially when the magnets are used in a dynamic mode, and/or in combination with magnetic nanoparticles. In this book, the biological effects of static high magnetic fields with large gradient and no gradient are discussed, as well as magnetic field with nanoparticles. Furthermore, cellular studies of radiofrequency magnetic fields, as well as cellular, animal and some preliminary studies on human bodies of low frequency magnetic fields are also included. Overall, the researches about the biological effects of high magnetic fields are very interesting and inspiring, but still at a very initial stage. More studies are needed to promote the scientific development of this field, and their potential applications in medicine.

Sharply different from the above section, the NMR and MRI related works are much more advanced. The successful applications of NMR and MRI have enabled

numerous pioneering scientific findings in a wide range of life science subjects. In this book, recent progresses on protein-protein and protein-drug interactions, NMR spectroscopy in cell-like environment, NMR applications in measuring protein non-covalent interactions, and nanodiscs in examining protein-membrane interaction are presented. Topics on high-resolution NMR under inhomogeneous magnetic fields, ^{19}F NMR/MRI, ultrasensitive Xenon MRI and molecular imaging, are also included.

We would especially thank Dr. Baogen Shen and Dr. Yuheng Zhang for their support in organizing and publishing this book. We also want to thank Dr. Chaohui Ye and Dr. Yunyu Shi for their helpful suggestions. Moreover, we thank all authors and editor Jun Qian for their efforts. Due to time conflicts of the researchers and space limitations, we want to apologize for not being able to include the works of many outstanding researchers and their exceptional discoveries in the field of NMR and MRI, as well as the clinical applications of magnetic fields in Transcranial Magnetic Stimulation (TMS) and the recently emerged Magnetic Surgery. However, we hope this book will inspire more people to get involved in using high magnetic field in their life science researches, and we are looking forward to more groundbreaking findings in the near future!

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